

Improving NEMO Diagnostics with GPU Port and Asynchronous Execution

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Motivation

- Efficient IOs and diagnostics for operational systems
 - Improvement of NEMO I/O management in an operational system
 - Explore the usage of high performance data analytics solutions to compute online diagnostics.
 - Offloading model diagnostics from NEMO.
 - Fat nodes (CMCC)
 - **GPUs (BSC)** Demonstration template of custom diagnostics
 - Benchmark with real diagnostics using real configurations

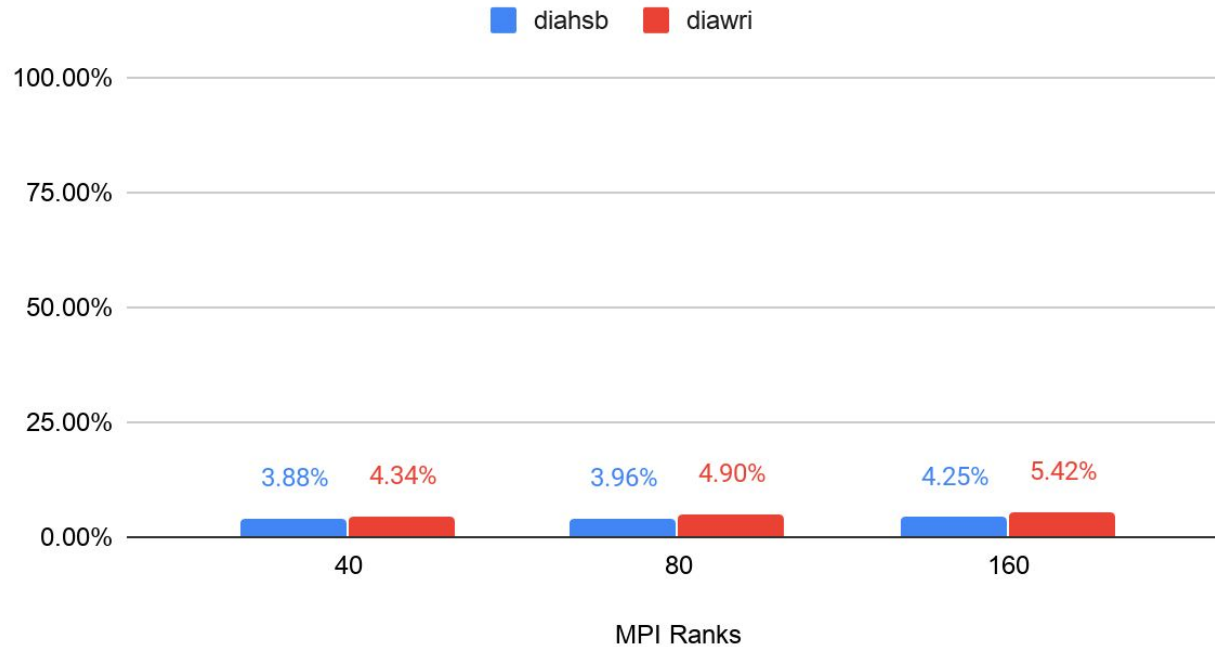
NEMO GPU Port - Diagnostics

Targets for GPU porting

- Diagnostics
 - Offline
 - Time footprint
 - Computation intensive
 - Sequence of data movement H2D, computation, and again data movement D2H

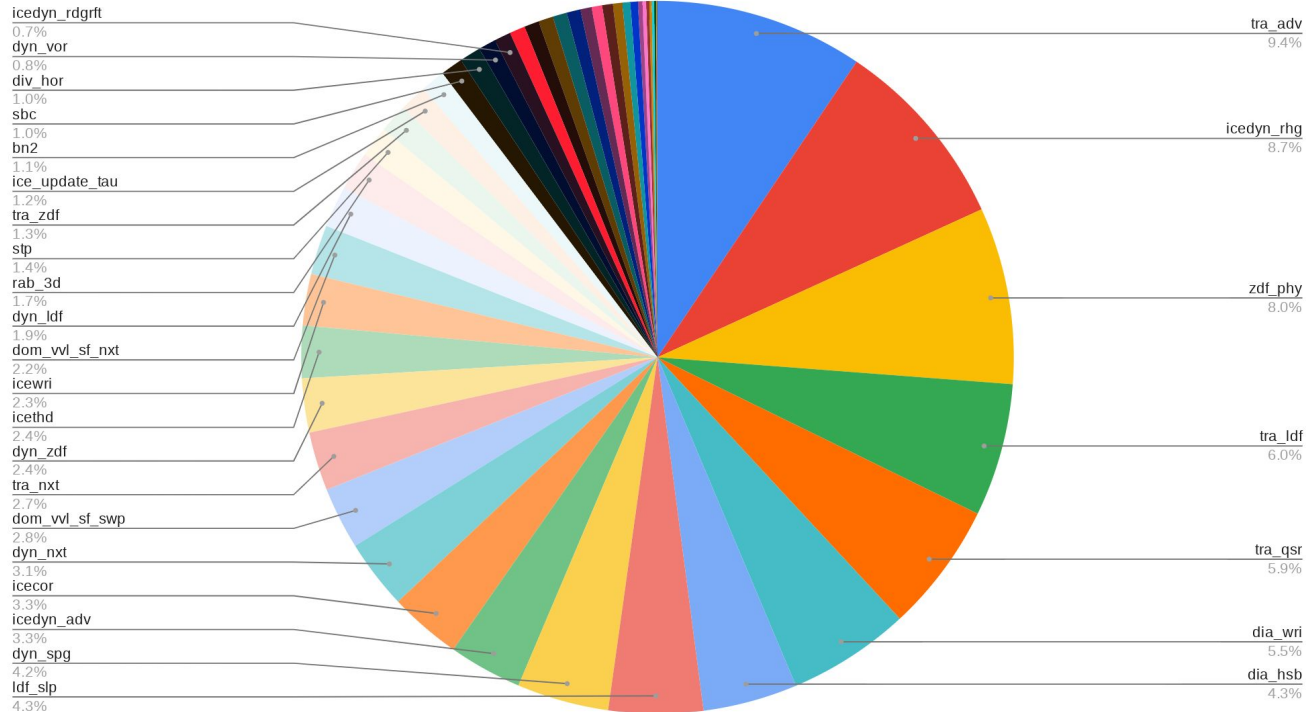
NEMO GPU Port - Diagnostics

Time footprint ORCA 1/4



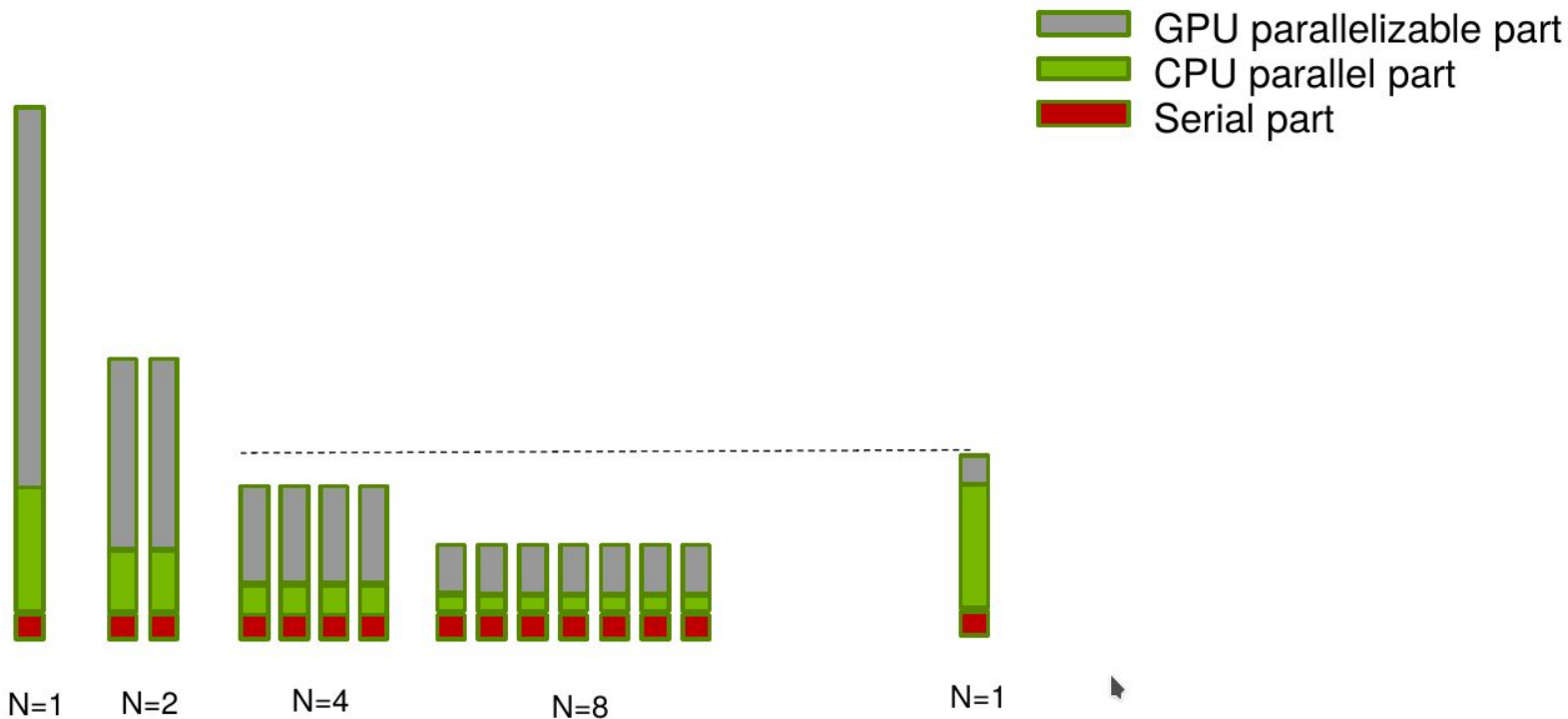
NEMO GPU Port Diagnostics

time(%) vs. sub-routine



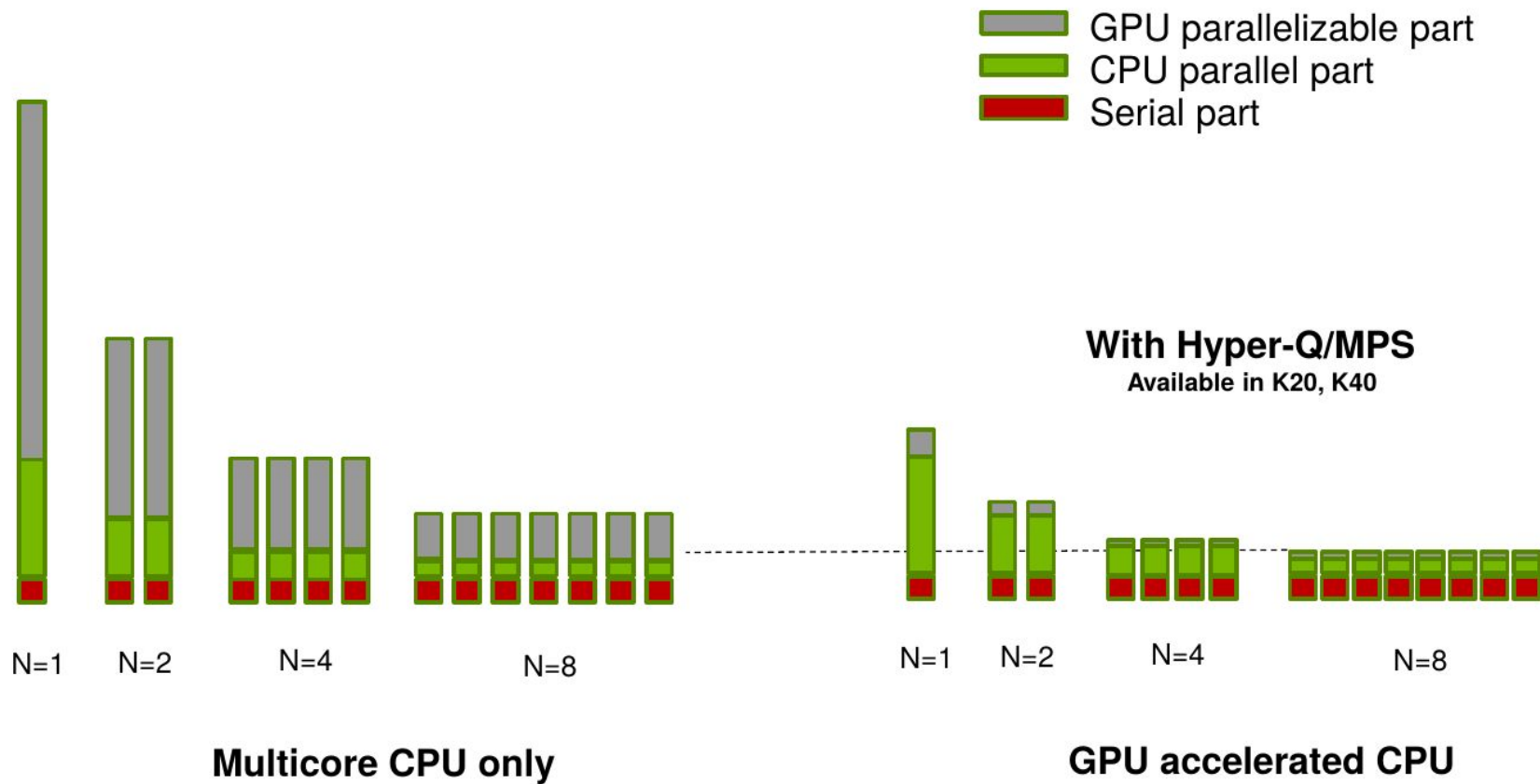
NEMO GPU Port - Diagnostics

- Diahsb
 - Salinity, Heat and Volume related evaluations
 - Involve mainly variable array tsn
- Diawri
 - Several physical calculation
 - Involve mainly variable array tsn, ssh, rCdU_bot, wv, vv etc

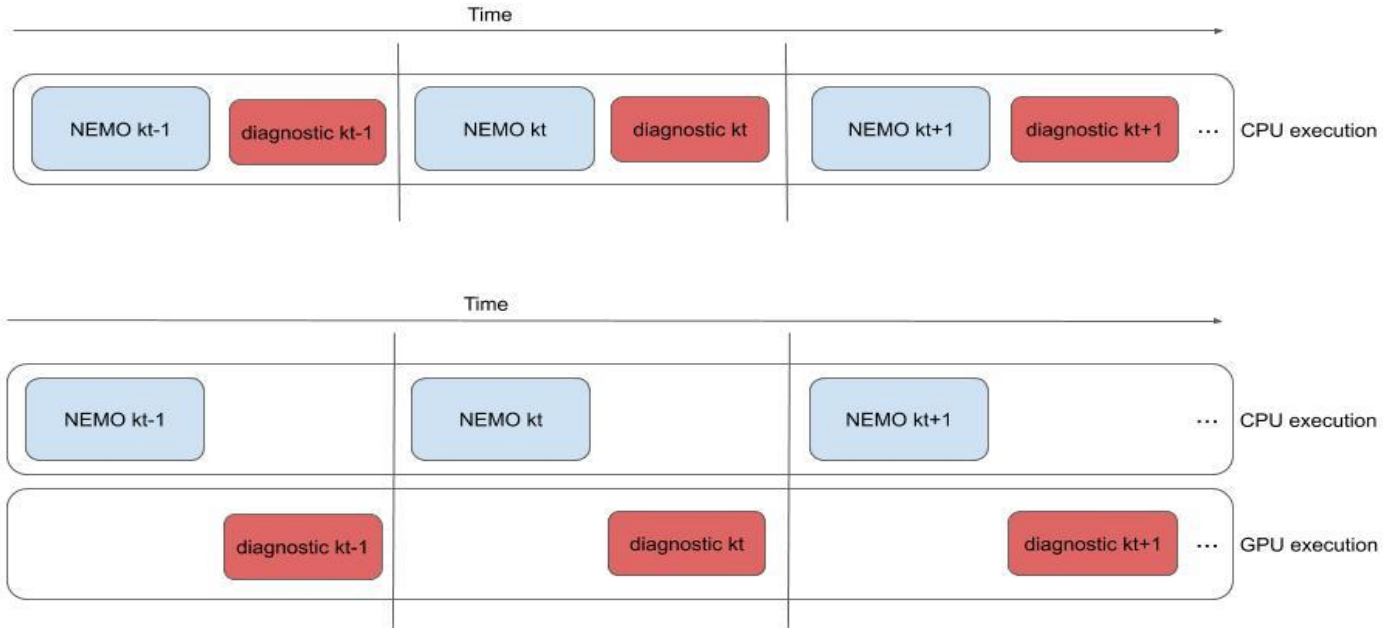


Multicore CPU only

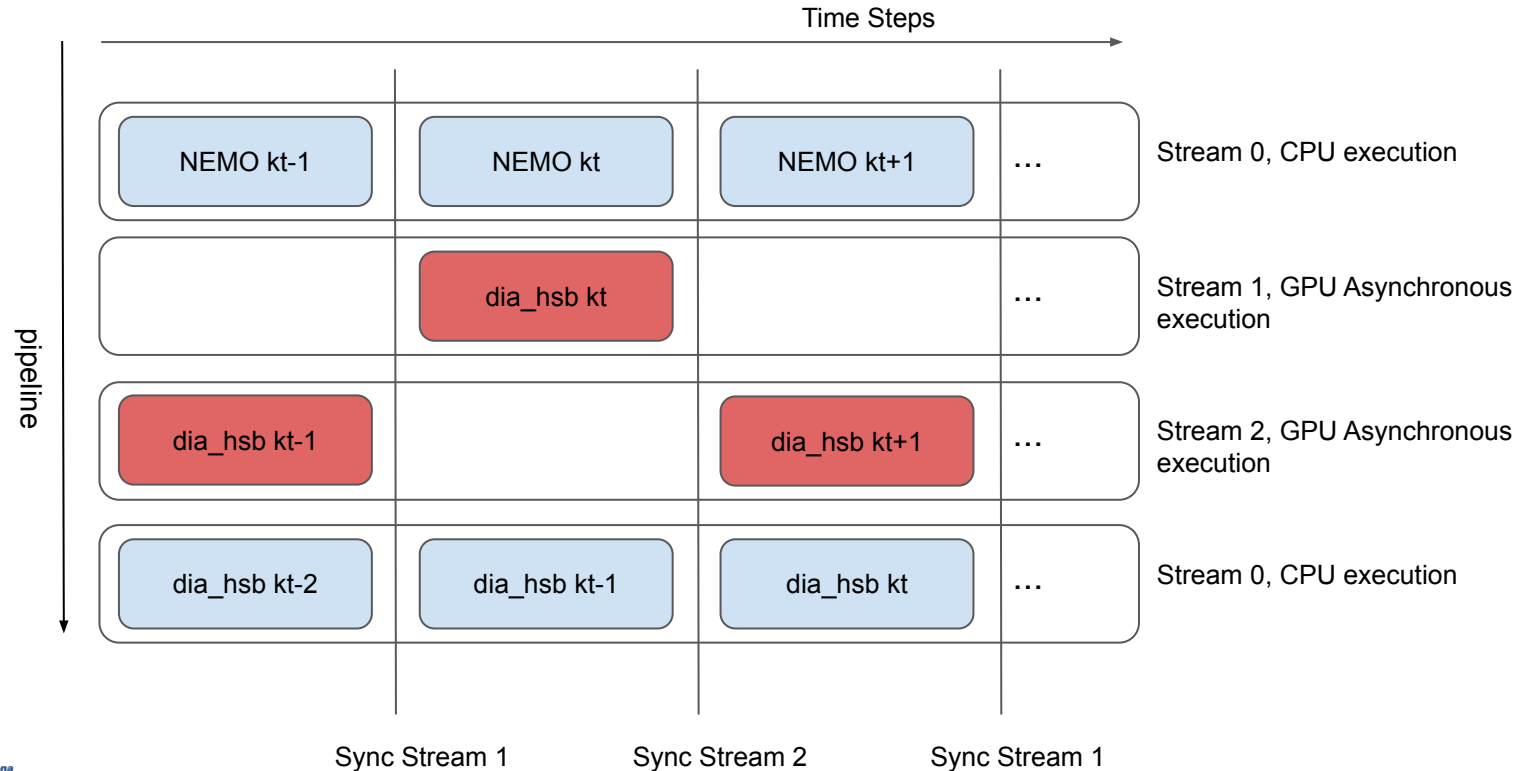
GPU accelerated CPU



Conventional Synchronous Port

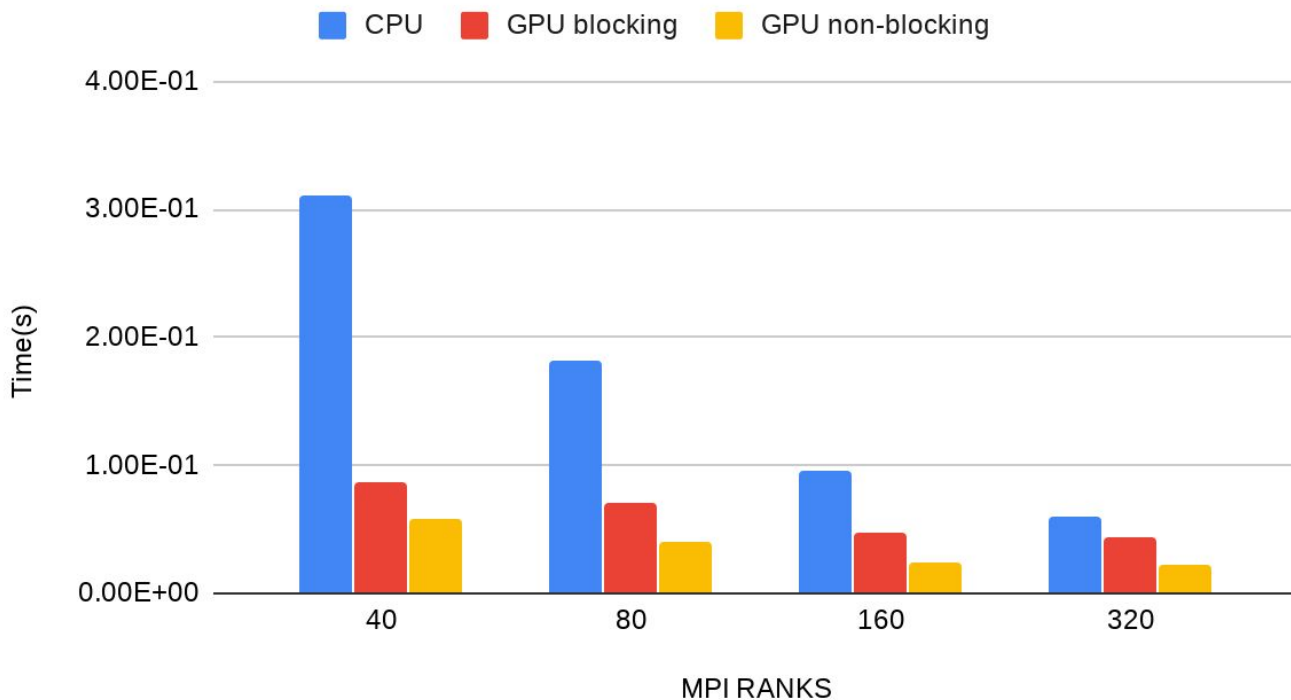


Asynchronous Diagnostic



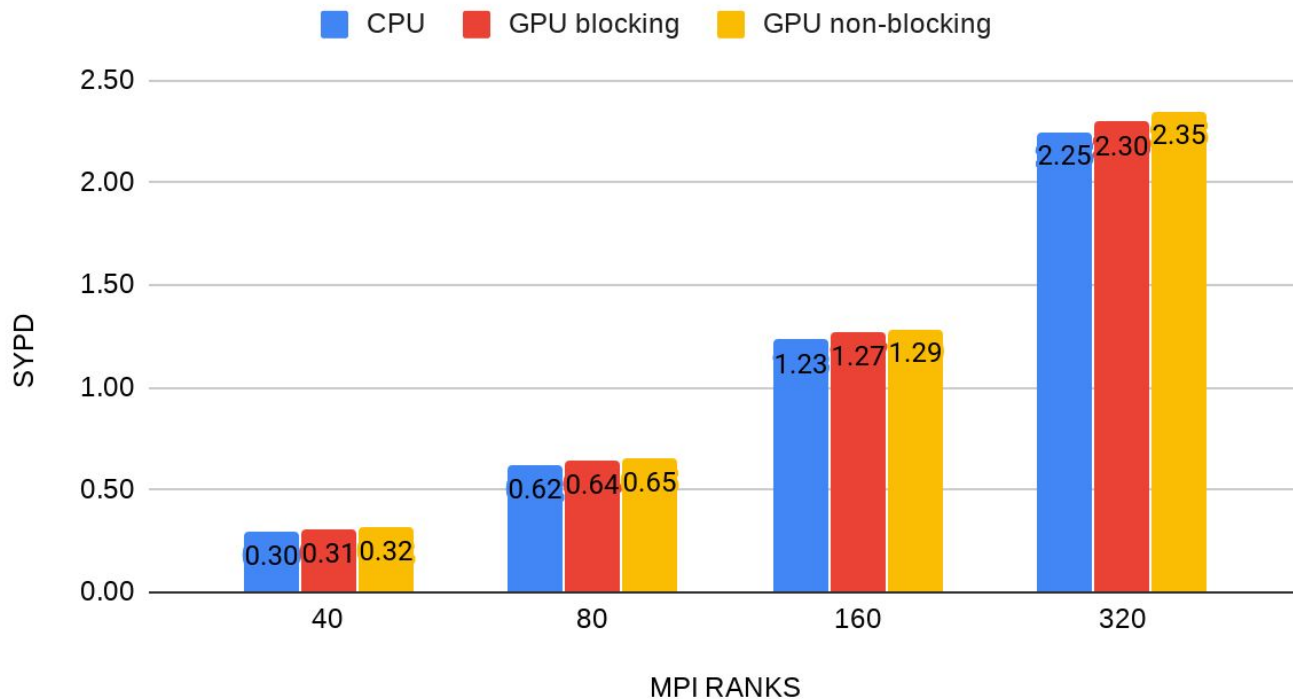
Strong Scale

ORCA 1/4, DIA_HSB avg. time per call.



Strong Scale

CPU, GPU blocking and GPU non-blocking



NEMO speedup - ORCA025

Configuration (2000 steps, 320 MPI)	SYPD	Speed-up
CPU	2.250	1
GPU+MPS	2.296	1.020
GPU+MPS+Async, 4 GPU/node	2.351	1.045
GPU+MPS+Async, 2 GPU/node	2.348	1.044

- To-Do
 - Explore issues of pinned memory management on diawri
 - Package GPU diagnostic port
 - Submit
- Achievements
 - Diahsb diagnostic ported
 - Demonstration template of custom diagnostics
- Future
 - NEMO GPU porting beyond diagnostics



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